



# 10-Bit, 40MHz Sampling ANALOG-TO-DIGITAL CONVERTERS

## FEATURES

- HIGH SNR: 60dB
- HIGH SFDR: 72dBFS
- LOW POWER: 190mW
- INTERNAL/EXTERNAL REFERENCE OPTION
- SINGLE-ENDED OR FULLY DIFFERENTIAL ANALOG INPUT
- PROGRAMMABLE INPUT RANGE
- LOW DNL: 0.5LSB
- SINGLE +5V SUPPLY OPERATION

- +3V OR +5V LOGIC I/O COMPATIBLE (ADS825)
- POWER DOWN: 20mW
- SSOP-28 PACKAGE

## APPLICATIONS

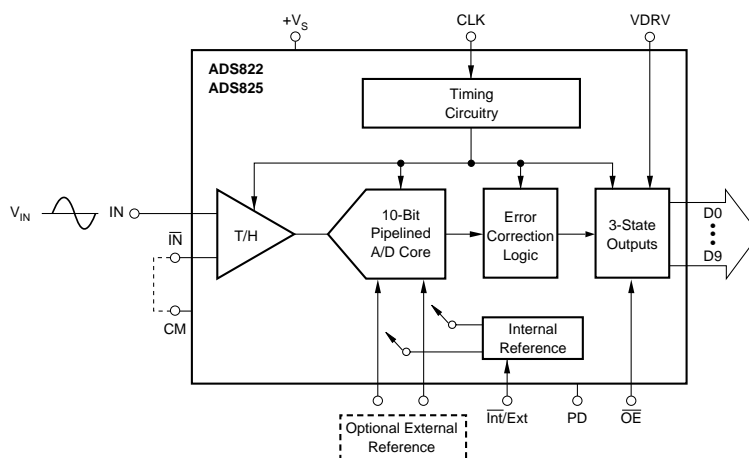
- MEDICAL IMAGING
- TEST EQUIPMENT
- COMPUTER SCANNERS
- COMMUNICATIONS
- VIDEO DIGITIZING

## DESCRIPTION

The ADS822 and ADS825 are pipeline, CMOS Analog-to-Digital Converters (ADC) that operate from a single +5V power supply. These converters provide excellent performance with a single-ended input and can be operated with a differential input for added spurious performance. These high-performance converters include a 10-bit quantizer, high-bandwidth track-and-hold, and a high-accuracy internal reference. They also allow for the user to disable the internal reference and utilize external references. This external reference option provides excellent gain and offset matching when used in multichannel applications, or in applications where full-scale range adjustment is required.

The ADS822 and ADS825 employ digital error correction techniques to provide excellent differential linearity for demanding imaging applications. Its low distortion and high SNR give the extra margin needed for medical imaging, communications, video, and test instrumentation. The ADS822 and ADS825 offer power dissipation of 190mW and also provide a power-down mode, thus reducing power dissipation to only 20mW. The ADS825 is +3V or +5V logic I/O compatible.

The ADS822 and ADS825 are specified at a maximum sampling frequency of 40MSPS and a single-ended input range of 1.5V to 3.5V. The ADS822 and ADS825 are available in an SSOP-28 package and are pin-for-pin compatible with the 10-bit, 60MSPS ADS823 and ADS826, and the 10-bit, 75MSPS ADS828, providing an upgrade path to higher sampling frequencies.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

+V <sub>S</sub> .....	+6V
Analog Input .....	–0.3V to (+V <sub>S</sub> + 0.3V)
Logic Input .....	–0.3V to (+V <sub>S</sub> + 0.3V)
Case Temperature .....	+100°C
Junction Temperature .....	+150°C
Storage Temperature .....	+150°C

NOTE: (1) Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability.

## DEMO BOARD ORDERING INFORMATION

PRODUCT	DEMO BOARD
ADS822E	DEM-ADS822E

## PACKAGE/ORDERING INFORMATION

PRODUCT	PACKAGE-LEAD	PACKAGE DESIGNATOR <sup>(1)</sup>	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	ORDERING NUMBER	TRANSPORT MEDIA, QUANTITY
ADS822	SSOP-28	DB	–40°C to +85°C	ADS822E	ADS822E	Rails,
"	"	"	"	"	ADS822E/1K	Tape and Reel, 1000
ADS825	SSOP-28	DB	–40°C to +85°C	ADS825E	ADS825E	Rails,
"	"	"	"	"	ADS825E/1K	Tape and Reel, 1000

NOTES: (1) For the most current specifications and package information, refer to our web site at [www.ti.com](http://www.ti.com).

## ELECTRICAL CHARACTERISTICS

At T<sub>A</sub> = full specified temperature range, V<sub>S</sub> = +5V, single-ended input range = 1.5V to 3.5V, sampling rate = 40MHz and, external reference, unless otherwise noted.

PARAMETER	CONDITIONS	ADS822E			ADS825E <sup>(1)</sup>			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
<b>RESOLUTION</b>			10			10		Bits
<b>SPECIFIED TEMPERATURE RANGE</b>	Ambient Air		–40 to +85			–40 to +85		°C
<b>ANALOG INPUT</b>								
Standard Single-Ended Input Range	2Vp-p	1.5		3.5	*		*	V
Optional Single-Ended Input Range	1Vp-p	2		3	*		*	V
Common-Mode Range			2.5			*		V
Optional Differential Input Range	2Vp-p	2		3	*		*	V
Analog Input Bias Current			1			*		μA
Input Impedance			1.25    5			*		MΩ    pF
Track-Mode Input Bandwidth	–3dBFS Input		300			*		MHz
<b>CONVERSION CHARACTERISTICS</b>								
Sample Rate		10k		40M	*		*	Samples/s
Data Latency			5			*		Clk Cyc
<b>DYNAMIC CHARACTERISTICS</b>								
Differential Linearity Error (largest code error)			±0.25	±1.0		*	*	LSB
f = 1MHz			±0.5			*		LSB
f = 10MHz			Tested			Tested		
No Missing Codes			±0.5	±2.0		*	*	LSBs
Integral Nonlinearity Error, f = 1MHz								
Spurious-Free Dynamic Range <sup>(2)</sup>	Referred to Full-Scale							
f = 1MHz			72			71		dBFS <sup>(3)</sup>
f = 10MHz		63	66		60	65		dBFS
2-Tone Intermodulation Distortion <sup>(4)</sup>			–67			*		dBc
f = 9.5MHz and 9.9MHz (–7dB each tone)								
Signal-to-Noise Ratio (SNR)	Referred to Full-Scale					*	*	dB
f = 1MHz			60			*		dB
f = 10MHz		57	60		*	*		
Signal-to-(Noise + Distortion) (SINAD)	Referred to Full-Scale					*	*	dB
f = 1MHz			59			*		dB
f = 10MHz		56	58		*	*		dB
Effective Number of Bits <sup>(5)</sup> , f = 1MHz			9.5			*		Bits
Output Noise	Input Tied to Common-Mode		0.2			*		LSBs rms
Aperture Delay Time			3			*		ns
Aperture Jitter			1.2			*		ps rms
Overvoltage Recovery Time			2			*		ns
Full-Scale Step Acquisition Time			5			*		ns



## ELECTROSTATIC DISCHARGE SENSITIVITY

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

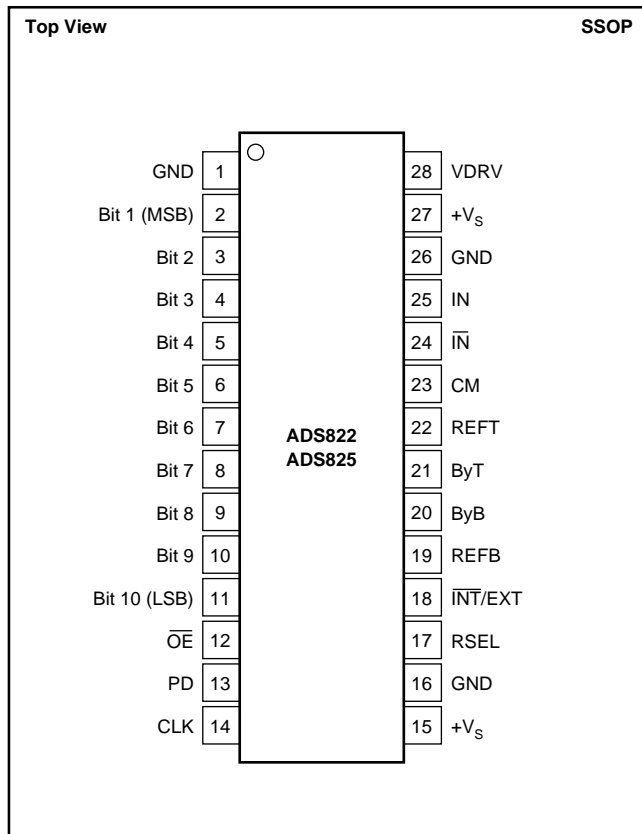
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

At  $T_A$  = full specified temperature range,  $V_S$  = +5V, single-ended input range = 1.5V to 3.5V, and sampling rate = 40MHz, external reference, unless otherwise noted.

\* Indicates the same specifications as the ADS822E.

NOTES: (1) ADS825E accepts a +3V clock input. (2) Spurious-Free Dynamic Range refers to the magnitude of the largest harmonic. (3) dBFS means dB relative to Full Scale. (4) Two-tone intermodulation distortion is referred to the largest fundamental tone. This number will be 6dB higher if it is referred to the magnitude of the two-tone fundamental envelope. (5) Effective number of bits (ENOB) is defined by  $(\text{SINAD} - 1.76)/6.02$ . (6) A 50k $\Omega$  pull-down resistor is inserted internally on  $\overline{\text{OE}}$  pin. (7) Includes internal reference. (8) Excludes internal reference. (9) Assured by design.

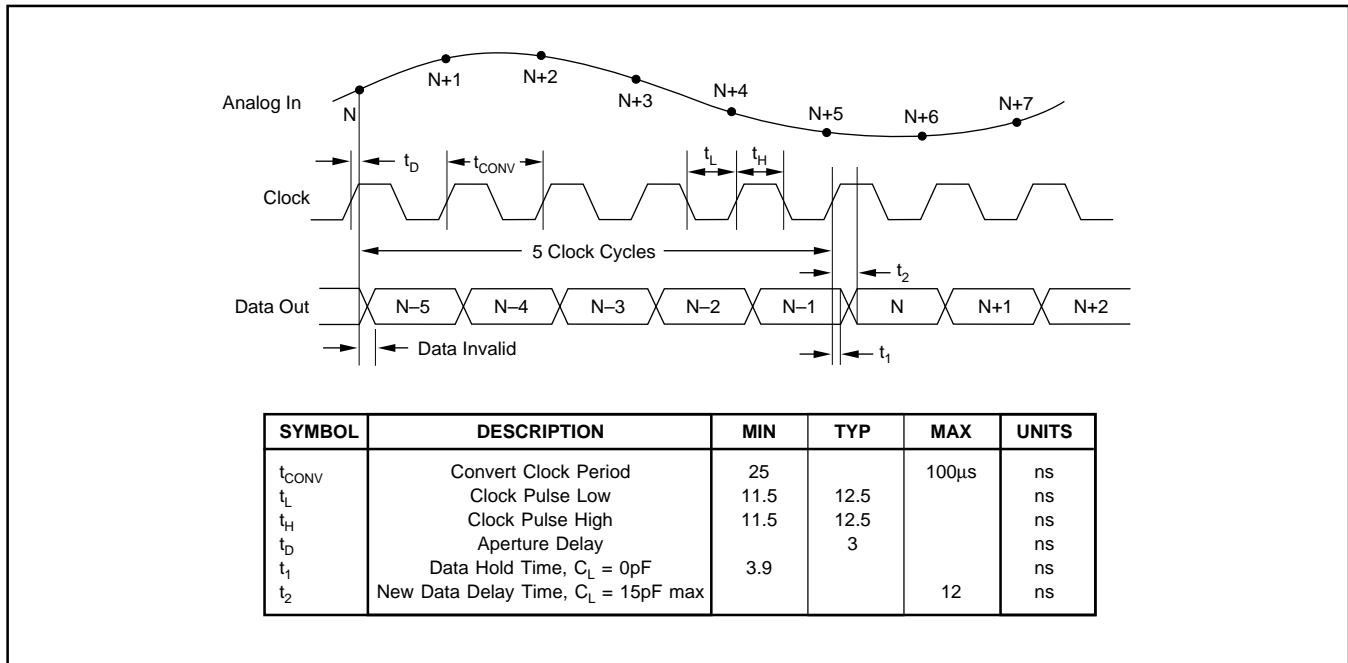
## PIN CONFIGURATION



## PIN DESCRIPTIONS

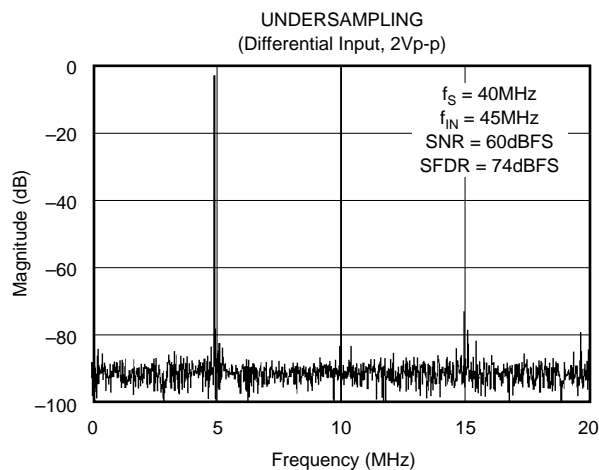
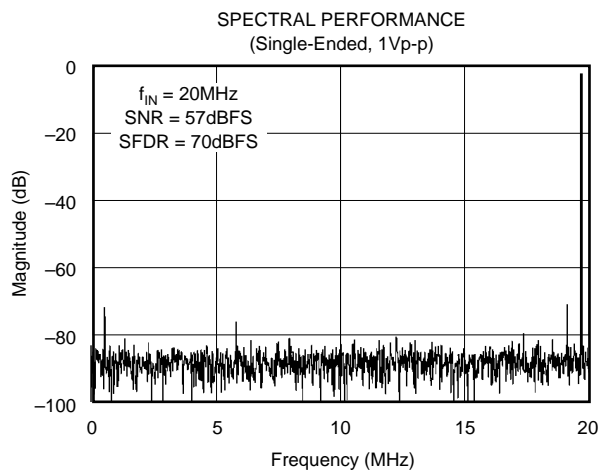
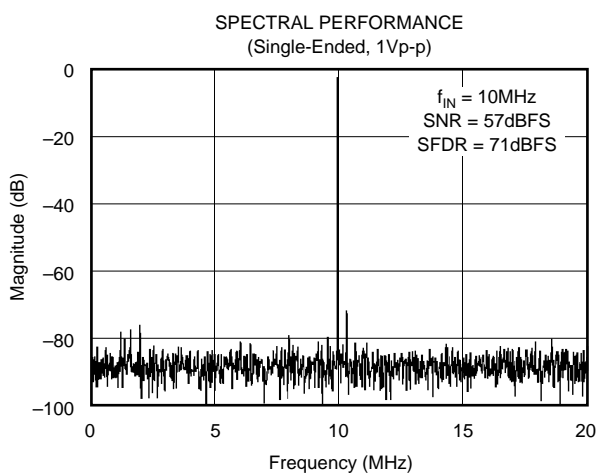
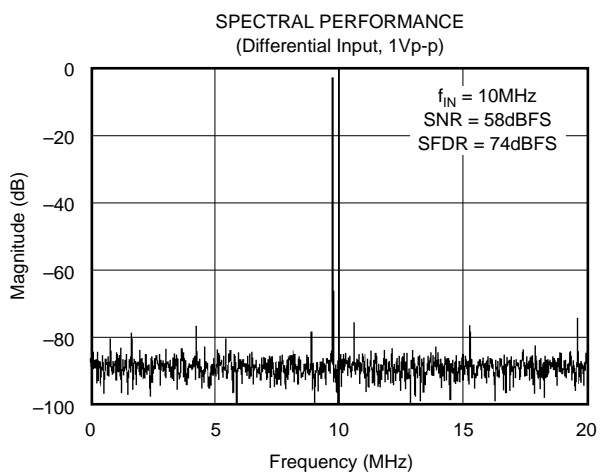
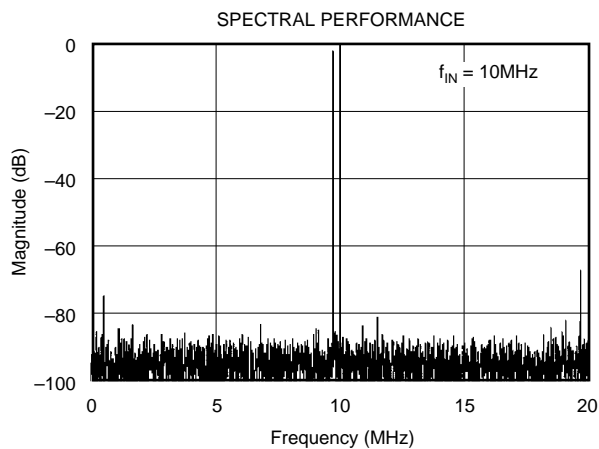
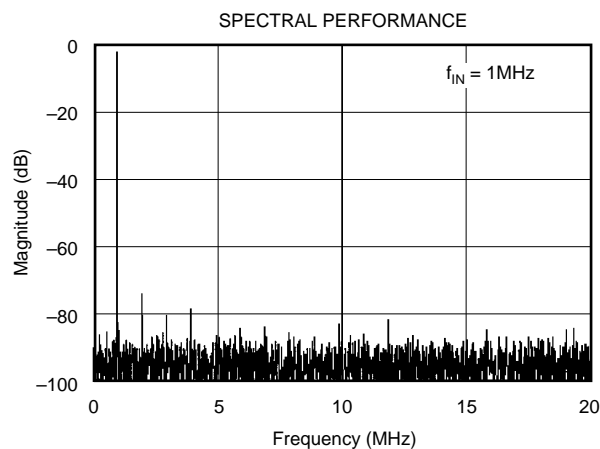
PIN	DESIGNATOR	DESCRIPTION
1	GND	Ground
2	Bit 1	Data Bit 1 (D9) (MSB)
3	Bit 2	Data Bit 2 (D8)
4	Bit 3	Data Bit 3 (D7)
5	Bit 4	Data Bit 4 (D6)
6	Bit 5	Data Bit 5 (D5)
7	Bit 6	Data Bit 6 (D4)
8	Bit 7	Data Bit 7 (D3)
9	Bit 8	Data Bit 8 (D2)
10	Bit 9	Data Bit 9 (D1)
11	Bit 10	Data Bit 10 (D0) (LSB)
12	$\overline{OE}$	Output Enable. HI = high impedance state LO = normal operation (internal pull-down resistor)
13	PD	Power Down. HI = enable; LO = disable
14	CLK	Convert Clock Input
15	$+V_S$	+5V Supply
16	GND	Ground
17	RSEL	Input Range Select. HI = 2V; LO = 1V
18	$\overline{INT/EXT}$	Reference Select. HI = external, LO = internal
19	REFB	Bottom Reference
20	ByB	Bottom Ladder Bypass
21	ByT	Top Ladder Bypass
22	REFT	Top Reference
23	CM	Common-Mode Voltage Output
24	$\overline{IN}$	Complementary Input (-)
25	IN	Analog Input (+)
26	GND	Analog Ground
27	$+V_S$	+5V Supply
28	VDRV	Output Logic Driver Supply Voltage

## TIMING DIAGRAM



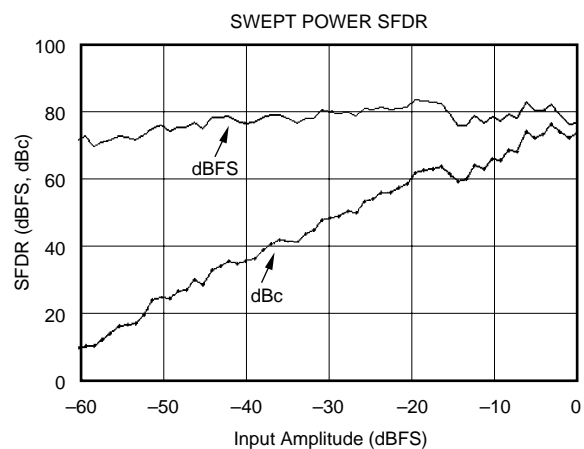
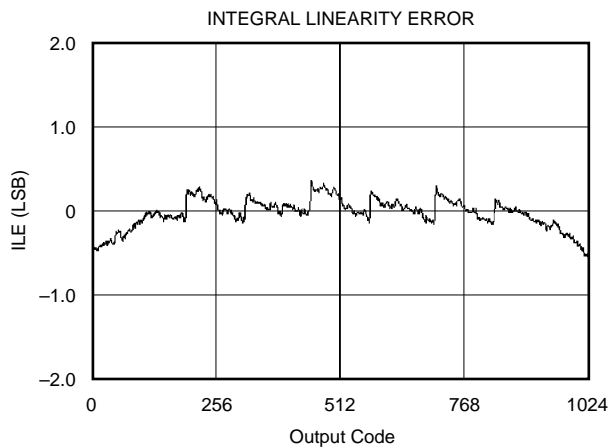
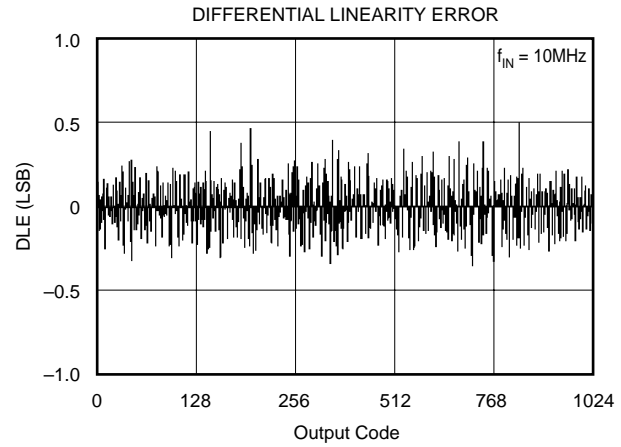
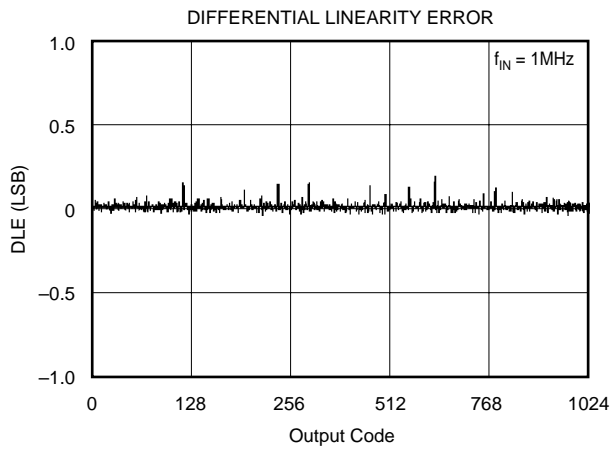
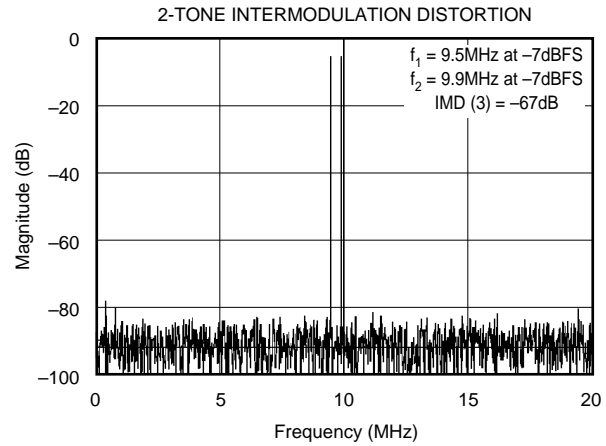
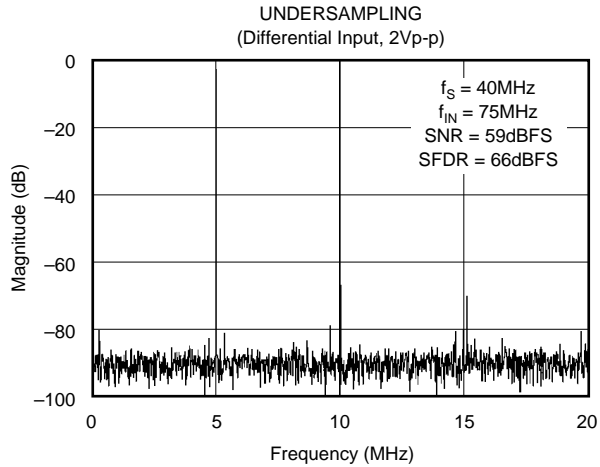
# ELECTRICAL CHARACTERISTICS

At  $T_A$  = full specified temperature range,  $V_S$  = +5V, single-ended input range = 1.5V to 3.5V, sampling rate = 40MHz, and external reference, unless otherwise noted.



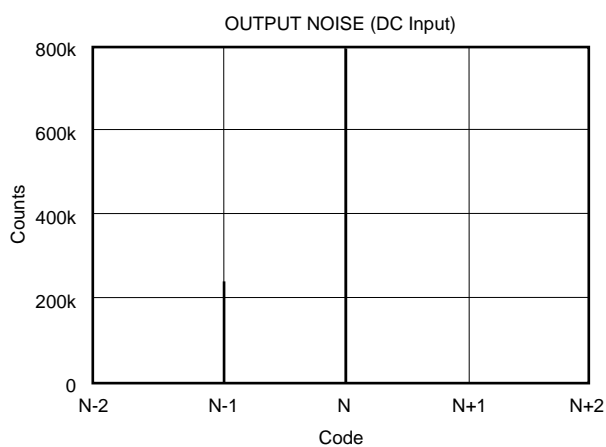
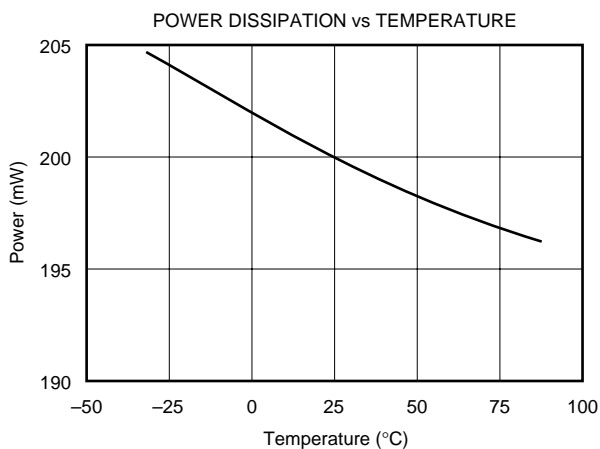
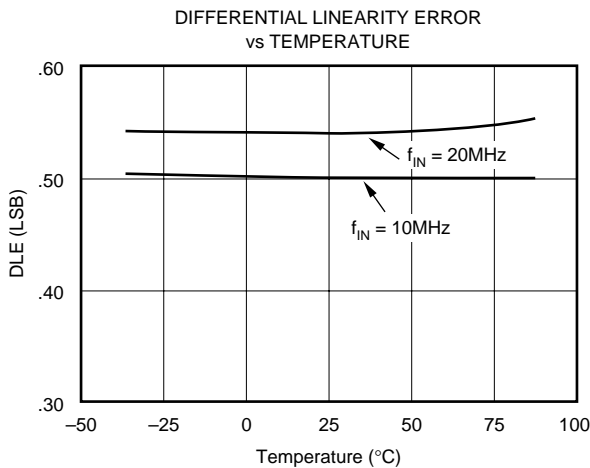
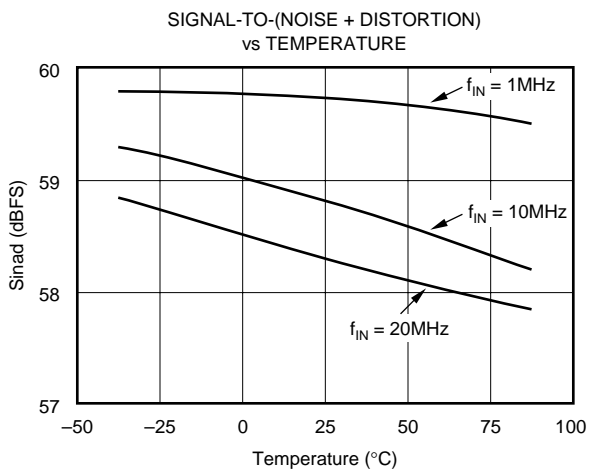
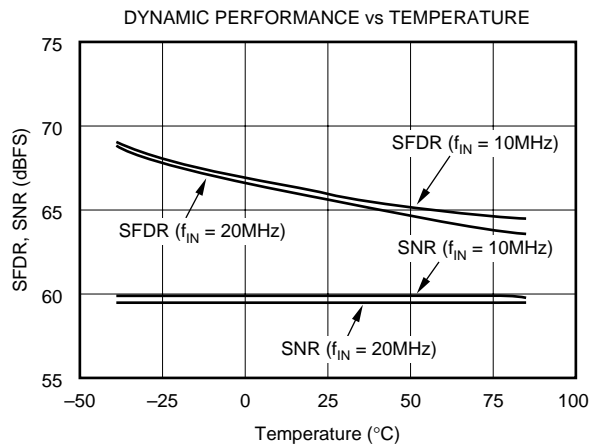
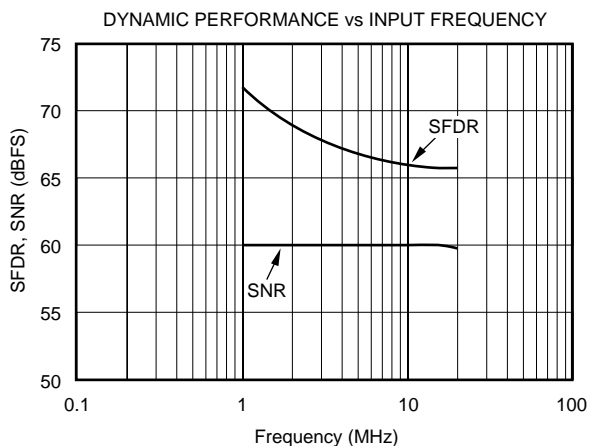
# ELECTRICAL CHARACTERISTICS (Cont.)

At  $T_A$  = full specified temperature range,  $V_S$  = +5V, single-ended input range = 1.5V to 3.5V, sampling rate = 40MHz, and external reference, unless otherwise noted.



# ELECTRICAL CHARACTERISTICS (Cont.)

At  $T_A$  = full specified temperature range,  $V_S$  = +5V, single-ended input range = 1.5V to 3.5V, sampling rate = 40MHz, and external reference, unless otherwise noted.



# APPLICATION INFORMATION

## THEORY OF OPERATION

The ADS822 and ADS825 are high-speed CMOS ADCs which employ a pipelined converter architecture consisting of nine internal stages. Each stage feeds its data into the digital error correction logic ensuring excellent differential linearity and no missing codes at the 10-bit level. The output data becomes valid on the rising clock edge (see Timing Diagram). The pipeline architecture results in a data latency of 5 clock cycles.

The analog inputs of the ADS822 and ADS825 are differential track-and-hold, as shown in Figure 1. The differential topology, along with tightly matched capacitors, produce a high level of AC performance while sampling at very high rates.

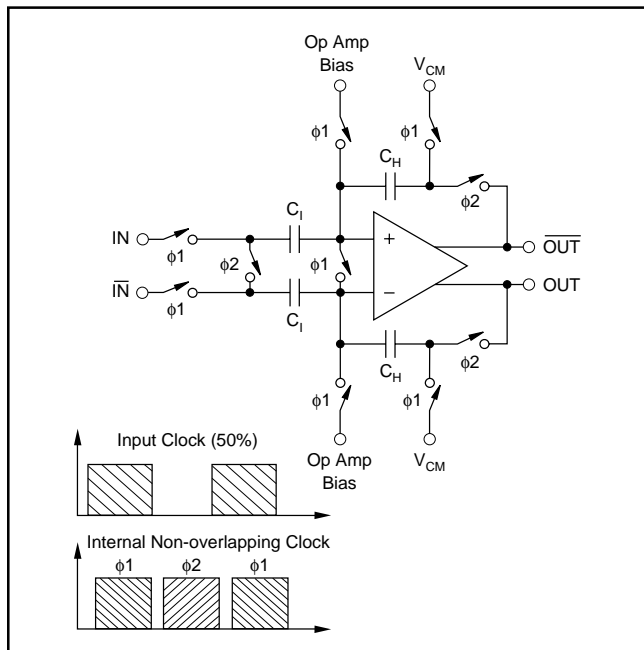


FIGURE 1. Simplified Circuit of Input Track-and-Hold with Timing Diagram.

The ADS822 and ADS825 allow their analog inputs to be driven either single-ended or differentially. The typical configuration for the ADS822 and ADS825 is the single-ended mode in which the input track-and-hold performs a single-ended-to-differential conversion of the analog input signal.

Both inputs (IN,  $\overline{\text{IN}}$ ) require external biasing using a common-mode voltage that is typically at the mid-supply level ( $+V_S/2$ ).

The following application discussion focuses on the single-ended configuration. Typically, its implementation is easier to achieve and the rated specifications for the ADS822 and ADS825 are characterized using the single-ended mode of operation.

## DRIVING THE ANALOG INPUT

The ADS822 and ADS825 achieve excellent AC performance either in the single-ended or differential mode of operation.

The selection for the optimum interface configuration will depend on the individual application requirements and system structure. For example, communications applications often process a band of frequencies that do not include DC, whereas in imaging applications, the previously restored DC level must be maintained correctly up to the ADC. Features on the ADS822 and ADS825, such as the input range select (RSEL pin) or the option for an external reference, provide the needed flexibility to accommodate a wide range of applications. In any case, the ADS822 and ADS825 should be configured such that the application objectives are met while observing the headroom requirements of the driving amplifier in order to yield the best overall performance.

## INPUT CONFIGURATIONS

### AC-Coupled, Single-Supply Interface

See Figure 2 for the typical circuit for an AC-coupled analog input configuration of the ADS822 and ADS825 while all components are powered from a single +5V supply.

With the RSEL pin connected HI, the full-scale input range is set to 2Vp-p. In this configuration, the top and bottom references (REFT, REFB) provide an output voltage of +3.5V and +1.5V, respectively. Two resistors ( $2 \times 1.62\text{k}\Omega$ ) are used to create a common-mode voltage ( $V_{CM}$ ) of approximately +2.5V to bias the inputs of the driving amplifier A1. Using the OPA680 on a single +5V supply, its ideal common-mode point is at +2.5V which coincides with the recommended common-mode input level for the ADS822 and ADS825. This obviates the need of a coupling capacitor between the amplifier and the converter. Even though the OPA680 has an AC gain of +2, the DC gain is only +1 due to the blocking capacitor at resistor  $R_G$ .

The addition of a small series resistor ( $R_S$ ) between the output of the op amp and the input of the ADS822 and ADS825 will be beneficial in almost all interface configurations. This will decouple the op amp's output from the capacitive load and avoid gain peaking, which can result in increased noise. For best spurious and distortion performance, the resistor value should be kept below  $100\Omega$ . Furthermore, the series resistor in combination with the 10pF capacitor establishes a passive low-pass filter limiting the bandwidth for the wideband noise, thus helping improve the SNR performance.

### AC-Coupled, Dual Supply Interface

The circuit provided in Figure 3 illustrates typical connections for the analog input in case the selected amplifier operates on dual supplies. This might be necessary to take full advantage of very low distortion operational amplifiers, like the OPA642. The advantage is that the driving amplifier can be operated with a ground-referenced bipolar signal swing. This will keep the distortion performance at its lowest, since the signal range stays within the linear region of the op amp and sufficient headroom to the supply rails can be maintained. By capacitively coupling the single-ended signal to the input of the ADS822 and ADS825, its common-mode requirements can easily be satisfied with two resistors connected between the top and bottom references.



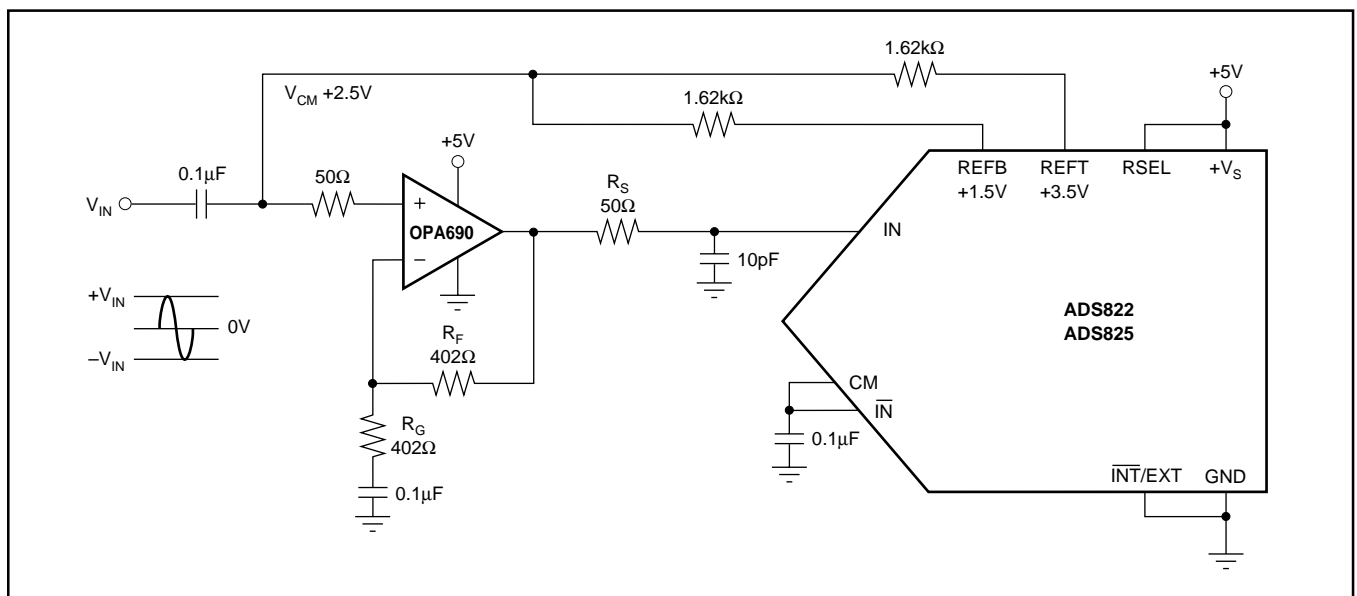


FIGURE 2. AC-Coupled Input Configuration for a 2Vp-p Full-Scale Range and a Common-Mode Voltage,  $V_{CM}$ , at +2.5V Derived From the Internal Top (REFT) and Bottom References (REFB).

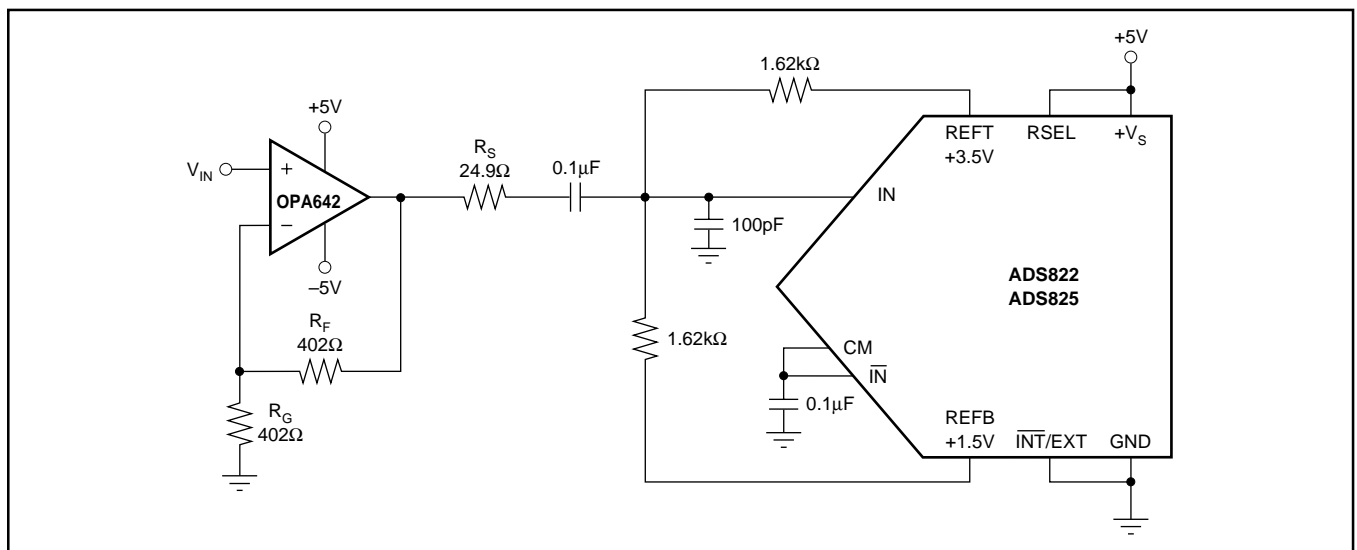


FIGURE 3. AC-Coupling the Dual Supply Amplifier, OPA642, to the ADS822 for a 2Vp-p Full-Scale Input Range.

For applications requiring the driving amplifier to provide a signal amplification, with a gain  $\geq 5$ , consider using decompensated voltage-feedback op amps, like the OPA686, or current-feedback op amps like the OPA691.

### DC-coupled with Level Shift

Several applications may require that the bandwidth of the signal path include DC, in which case, the signal has to be DC-coupled to the ADC. In order to accomplish this, the interface circuit has to provide a DC level shift to the analog input signal. See Figure 4 for a circuit that employs a dual op amp, A1, to drive the input of the ADS822 and ADS825, and level shifts the signal to be compatible with the selected input range. With the RSEL pin tied to the supply and the INT/EXT pin to ground, the ADS822 and ADS825 are configured for a 2Vp-p input range and use the internal references. The complementary input ( $\overline{IN}$ ) may be appropriately biased using

the +2.5V common-mode voltage available at the CM pin. One half of amplifier A1 buffers the REFB pin and drives the voltage dividers  $R_1$ ,  $R_2$ . Due to the op amp's noise gain of +2V/V, assuming  $R_F = R_{IN}$ , the common-mode voltage ( $V_{CM}$ ) has to be re-scaled to +1.25V. This results in the correct DC level of +2.5V for the signal input (IN). Any DC voltage differences between the  $\overline{IN}$  and IN inputs of the ADS822 and ADS825 effectively produces an offset, which can be corrected for by adjusting the resistor values of the divider,  $R_1$  and  $R_2$ . The selection criteria for a suitable op amp should include the supply voltage, input bias current, output voltage swing, distortion, and noise specification. Note that in this example, the overall signal phase is inverted. To re-establish the original signal polarity, it is always possible to interchange the  $\overline{IN}$  and IN connections.



resistive reference ladder. The bandgap reference circuit includes logic functions that allows setting the analog input swing of the ADS822 and ADS825 to either a 1Vp-p or 2Vp-p full-scale range simply by tying the RSEL pin to a Low or High potential, respectively. While operating the ADS822 in the external reference mode, the buffer amplifiers for the REFT and REFB are disconnected from the reference ladder.

As shown, the ADS822 and ADS825 have internal 50kΩ pull-up resistors at the range select pin (RSEL) and reference select pin ( $\overline{\text{INT}}/\text{EXT}$ ). Leaving these pins open configures the ADS822 and ADS825 for a 2Vp-p input range and external reference operation. Setting the ADS822 and ADS825 up for internal reference mode requires bringing the  $\overline{\text{INT}}/\text{EXT}$  pin Low.

The reference buffers can be utilized to supply up to 1mA (sink and source) to external circuitry. The resistor ladders of the ADS822 and ADS825 are divided into several segments and have two additional nodes, ByT and ByB, which are brought out for external bypassing only (see Figure 6). To ensure proper operation with any reference configurations, it is necessary to provide solid bypassing at all reference pins in order to keep the clock feedthrough to a minimum. All bypassing capacitors should be located as close to their respective pins as possible.

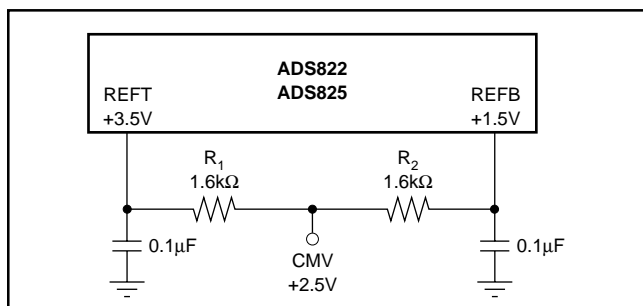


FIGURE 7. Alternative Circuit to Generate CM Voltage.

The common-mode voltage available at the CM pin may be used as a bias voltage to provide the appropriate offset for the driving circuitry. However, care must be taken not to appreciably load this node, which is not buffered and has a high impedance. An alternative way of generating a common-mode voltage is given in Figure 7. Here, two external precision resistors (tolerance 1% or better) are located between the top and bottom reference pins. The common-mode voltage, CMV, will appear at the midpoint.

## EXTERNAL REFERENCE OPERATION

For even more design flexibility, the internal reference can be disabled and an external reference voltage be used. The utilization of an external reference may be considered for applications requiring higher accuracy, improved temperature performance, or a wide adjustment range of the converter's full-scale range. Especially in multichannel applications, the use of a common external reference has the benefit of obtaining better matching of the full-scale range between converters.

The external references can vary as long as the value of the external top reference  $\text{REFT}_{\text{EXT}}$  stays within the range of ( $V_S - 1.25\text{V}$ ) and ( $\text{REFB} + 0.8\text{V}$ ), and the external bottom reference  $\text{REFB}_{\text{EXT}}$  stays within 1.25V and ( $\text{REFT} - 0.8\text{V}$ ) (See Figure 8).

## DIGITAL INPUTS AND OUTPUTS

### Clock Input Requirements

Clock jitter is critical to the SNR performance of high-speed, high-resolution ADCs. Clock jitter leads to aperture jitter ( $t_A$ ), which adds noise to the signal being converted. The ADS822 and ADS825 samples the input signal on the rising edge of the CLK input. Therefore, this edge should have the lowest possible jitter. The jitter noise contribution to total SNR is given by

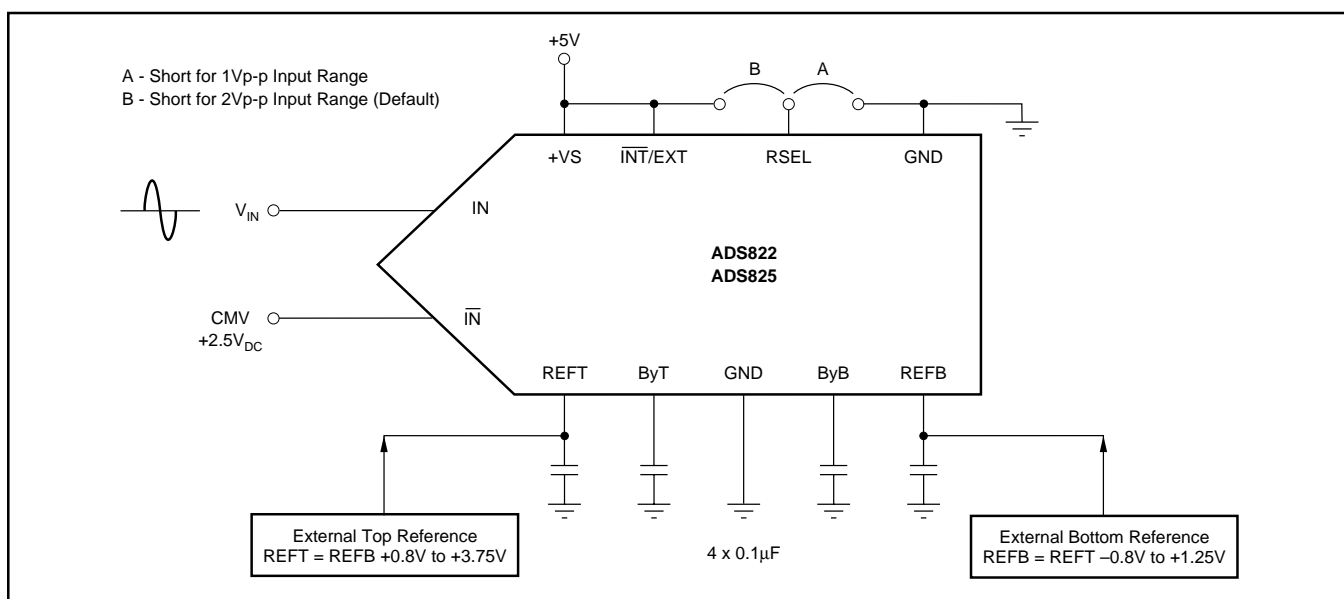


FIGURE 8. Configuration Example for External Reference Operation.

the following equation. If this value is near your system requirements, input clock jitter must be reduced.

$$\text{Jitter SNR} = 20 \log \frac{1}{2\pi f_{\text{IN}} t_A} \text{rms signal to rms noise}$$

where:  $f_{\text{IN}}$  is input signal frequency  
 $t_A$  is rms clock jitter

Particularly in undersampling applications, special consideration should be given to clock jitter. The clock input should be treated as an analog input in order to achieve the highest level of performance. Any overshoot or undershoot of the clock signal may cause degradation of the performance. When digitizing at high sampling rates, the clock should have 50% duty cycle ( $t_H = t_L$ ), along with fast rise and fall times of 2ns or less. The clock input of the ADS825 can be driven with either 3V or 5V logic levels. Using low-voltage logic (3V) may lead to improved AC performance of the converter.

## Digital Outputs

The output data format of the ADS822 and ADS825 are in positive Straight Offset Binary code, as shown in Tables I and II. This format can easily be converted into the Binary Two's Complement code by inverting the MSB.

It is recommended to keep the capacitive loading on the data lines as low as possible ( $\leq 15\text{pF}$ ). Higher capacitive loading will cause larger dynamic currents as the digital outputs are changing. Those high current surges can feed back to the analog portion of the ADS822 and ADS825 and affect the performance. If necessary, external buffers or latches close to the converter's output pins may be used to minimize the capacitive loading. They also provide the added benefit of isolating the ADS822 and ADS825 from any digital noise activities on the bus coupling back high frequency noise.

SINGLE-ENDED INPUT ( $\text{IN} = \text{CMV}$ )	STRAIGHT OFFSET BINARY (SOB)
+FS -1LSB ( $\text{IN} = \text{REFT}$ )	11 1111 1111
+1/2 Full Scale	11 0000 0000
Bipolar Zero ( $\text{IN} = \text{CMV}$ )	10 0000 0000
-1/2 Full Scale	01 0000 0000
-FS ( $\text{IN} = \text{REFB}$ )	00 0000 0000

TABLE I. Coding Table for Single-Ended Input Configuration with  $\text{IN}$  Tied to the Common-Mode Voltage (CMV).

DIFFERENTIAL INPUT	STRAIGHT OFFSET BINARY (SOB)
+FS -1LSB ( $\text{IN} = +3\text{V}$ , $\overline{\text{IN}} = +2\text{V}$ )	11 1111 1111
+1/2 Full Scale	11 0000 0000
Bipolar Zero ( $\text{IN} = \overline{\text{IN}} = \text{CMV}$ )	10 0000 0000
-1/2 Full Scale	01 0000 0000
-FS ( $\text{IN} = +2\text{V}$ , $\overline{\text{IN}} = +3\text{V}$ )	00 0000 0000

TABLE II. Coding Table for Differential Input Configuration and 2Vp-p Full-Scale Range.

## Digital Output Driver (VDRV)

The ADS822 features a dedicated supply pin for the output logic drivers, VDRV, which are not internally connected to the other supply pins. Setting the voltage at VDRV to +5V or +3V, the ADS822 and ADS825 produce corresponding logic levels and can directly interface to the selected logic family. The output stages are designed to supply sufficient current to drive a variety of logic families. However, it is recommended to use the ADS822 and ADS825 with +3V logic supply. This will lower the power dissipation in the output stages due to the lower output swing and reduce current glitches on the supply line which may affect the AC-performance of the converter. In some applications, it might be advantageous to decouple the VDRV pin with additional capacitors or a pi filter.

## GROUNDING AND DECOUPLING

Proper grounding and bypassing, short lead length, and the use of ground planes are particularly important for high-frequency designs. Multilayer PC boards are recommended for best performance since they offer distinct advantages like minimizing ground impedance, separation of signal layers by ground layers, etc. The ADS822 and ADS825 should be treated as analog components. Whenever possible, the supply pins should be powered by the analog supply. This will ensure the most consistent results, since digital supply lines often carry high levels of noise which otherwise would be coupled into the converter and degrade the achievable performance. All ground connections on the ADS822 and ADS825 are internally joined together obviating the design of split ground planes. The ground pins (1, 16, 26) should directly connect to an analog ground plane which covers the PC board area around the converter. While designing the layout, it is important to keep the analog signal traces separated from any digital lines to prevent noise coupling onto the analog signal path. Due to their high sampling rates, the ADS822 and ADS825 generate high frequency current transients, and noise (clock feedthrough) that are fed back into the supply and reference lines. This requires that all supply and reference pins are sufficiently bypassed. Figure 9 shows the recommended decoupling scheme for the ADS822 and ADS825. In most cases,  $0.1\mu\text{F}$  ceramic chip capacitors at each pin are adequate to keep the impedance low over a wide frequency range. Their effectiveness largely depends on the proximity to the individual supply pin. Therefore, they should be located as close to the supply pins as possible. In addition, a larger bipolar capacitor ( $1\mu\text{F}$  to  $22\mu\text{F}$ ) should be placed on the PC board in proximity of the converter circuit.

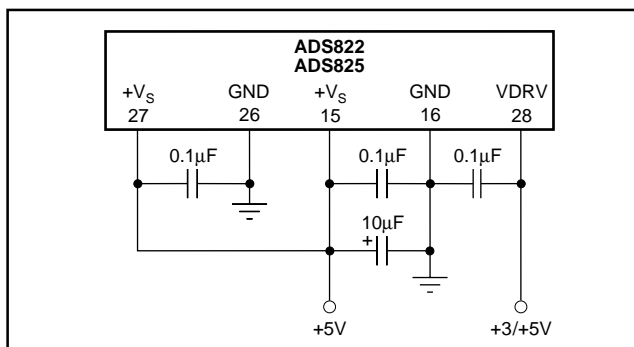


FIGURE 9. Recommended Bypassing for the Supply Pins.

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
ADS822E	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS822E	<a href="#">Samples</a>
ADS822E/1K	ACTIVE	SSOP	DB	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS822E	<a href="#">Samples</a>
ADS822E/1KG4	ACTIVE	SSOP	DB	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS822E	<a href="#">Samples</a>
ADS822EG4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS822E	<a href="#">Samples</a>
ADS825E	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS825E	<a href="#">Samples</a>
ADS825E/1K	ACTIVE	SSOP	DB	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS825E	<a href="#">Samples</a>
ADS825E/1KG4	ACTIVE	SSOP	DB	28	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS825E	<a href="#">Samples</a>
ADS825EG4	ACTIVE	SSOP	DB	28	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 85	ADS825E	<a href="#">Samples</a>

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBsolete:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
ADS822E/1K	SSOP	DB	28	1000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1
ADS825E/1K	SSOP	DB	28	1000	330.0	16.4	8.1	10.4	2.5	12.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
ADS822E/1K	SSOP	DB	28	1000	367.0	367.0	38.0
ADS825E/1K	SSOP	DB	28	1000	367.0	367.0	38.0



## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Space, Avionics and Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)